

SUBJECT: DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)

References: (a) DoD Directive 5000.59, "DoD Modeling and Simulation (M&S) Management," January 4, 1994
(b) DoD Directive 5000.1, "Defense Acquisition," February 23, 1991
(c) DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures," February 23, 1991
(d) DoD 5000.2-M, "Defense Acquisition Management Documentation and Reports," February 1991, authorized by DoD Instruction 5000.2, February 23, 1991
(e) through (l), see enclosure 1

A. PURPOSE

This Instruction implements policy, assigns responsibilities, and, prescribes procedures under reference (a) for the VV&A of DoD M&S.

B. APPLICABILITY AND SCOPE

This Instruction applies to:

1. The Office of the Secretary of Defense (OSD), the Military Departments, the Chairman of the Joint Chiefs of Staff, the Unified Combatant Commands, the Inspector General of the Department of Defense, the Defense Agencies, and the DoD Field Activities (hereafter referred to collectively as "the DoD Components").

2. All DoD M&S used after the effective date of this Instruction.

3. The development of other DoD Publications and documents, as needed, to provide DoD VV&A guidance.

4. The establishment of such boards and panels as may be necessary to further develop DoD VV&A policies, procedures, and plans.

C. DEFINITIONS

Terms used in this Instruction are defined in enclosure 2.

D. POLICY

It is DoD policy that:

1. DoD Components shall establish VV&A policies and procedures for M&S they develop and manage. The "DoD M&S Executive Agent" (MSEA) responsible for a common- or general-use M&S shall follow DoD Component VV&A policies and procedures for that application, unless otherwise specified by the Under Secretary of Defense for Acquisition and Technology (USD(A&T)).

2. M&S used to support the major DoD decisionmaking organizations and processes (such as the Defense Planning and Resources Board; the Defense Acquisition Board (DAB); the Joint Requirements Oversight Council; and the DoD Planning, Programming, and Budgeting System (described in references (b) through (f))) shall be accredited for that use by the DoD Component sponsoring the application. Likewise, M&S used for joint training and joint exercises shall be accredited for that purpose by the application sponsor.

3. Each DoD Component shall be the final authority for validating representations of its own forces and capabilities in joint-, general-, and common-use M&S applications and shall be responsive to the other DoD Components to ensure they are appropriately represented.

E. RESPONSIBILITIES

1. The Under Secretary of Defense for Acquisition and Technology shall:

a. Encourage VV&A activities across the Department of Defense.

b. In coordination with the DoD Components, develop policies, procedures, and DoD publications for the management and advancement of VV&A of DoD M&S.

c. Through the DoD Executive Council on Modeling and Simulation (EXCIMS):

(1) Encourage improved communication and coordination among and between DoD VV&A activities.

(2) Identify and support investments in VV&A enabling technologies that have high-value return in fulfilling DoD requirements, or that fill gaps in DoD VV&A capabilities.

(3) Promote joint and cooperative research, development, acquisition, and application of VV&A technologies and processes among the DoD Components.

(4) Recommend DoD VV&A goals and objectives, and develop an investment strategy and plan to achieve them in support of the DoD M&S Master Plan and DoD M&S Investment Plan.

(5) Establish standards and guidelines to promote DoD VV&A procedural commonality.

(6) Establish procedures for resolving differences in representation of forces and capabilities among the DoD Components to ensure standardization in joint, general, and common-use M&S applications and federations of models and simulations.

d. Include appropriate VV&A activities and resources in the DoD M&S Master Plan and Investment Plan.

e. Undertake additional DoD Component responsibilities as stated in subsection E.3., below.

f. Designate the Defense Modeling and Simulation Office (DMSO) as the "DoD VV&A focal point" to be the central source of DoD VV&A data and information and to assist DoD and non-DoD organizations, as requested, in resolving VV&A issues or obtaining information on DoD VV&A practices.

g. Make information and data on VV&A activities readily available through the DoD M&S Resource Repository (MSRR) system including, as a minimum, DoD Component VV&A policies and procedures, V&V results, and accreditation documentation.

2. The Assistant Secretary of Defense for Command, Control, Communications and Intelligence shall:

a. Through the Director, Defense Intelligence Agency, coordinate the VV&A of foreign threat forces with the appropriate threat authorities.

b. Undertake additional DoD Component responsibilities as stated in subsection E.3., below.

3. The Heads of the DoD Components shall:

a. Plan and provide resources, as needed, to carry out functional VV&A responsibilities according to DoD Component priorities.

b. Review and coordinate DoD VV&A policies and procedures, and DoD publications.

c. Develop implementation or supplementation documents for this Instruction, as appropriate, and forward one copy to the USD(A&T) within 120 days of the effective date of this Instruction.

d. Include appropriate VV&A activities and resources in DoD Component M&S Master Plan and Investment Plan.

e. Establish VV&A policies, procedures, and guidelines for M&S applications when required by DoD policy.

f. Prepare VV&A reports, as appropriate, for each M&S application they manage.

g. Assume DoD-wide VV&A responsibility for a DoD common- or general-use M&S application, in response to guidance from the USD(A&T), when designated as a "DoD MSEA."

h. Document the results of VV&A activities. Make information and data on DoD Component VV&A policies and procedures, V&V results, and accreditation documentation, as a minimum, accessible to the other DoD Components through the MSRR.

i. Designate a "VV&A focal point" for their VV&A activities, policies, procedures, and VV&A results and documentation and to interface with the DoD VV&A focal point.

4. The Chairman of the Joint Chiefs of Staff, in coordination with the Commanders in Chief of the Unified Combatant Commands, shall:

a. Establish the VV&A policies, procedures, and guidelines to satisfy the needs of other joint activities reporting to the Chairman of the Joint Chiefs of Staff.

b. In coordination with the other DoD Components, establish procedures for the accreditation of joint M&S and federations of M&S used for joint applications.

c. Ensure that accreditation documentation is maintained and accessible.

d. Undertake additional DoD Component responsibilities as listed in subsection E.3., above.

F. PROCEDURES

1. DoD Component VV&A policies and procedures shall address, as a minimum:

a. Existing and new M&S developments.

b. DoD Component-managed M&S that are elements of a federation of models and simulations.

c. DoD Component-managed M&S intended for joint-, general-, or common-use.

d. Responsibilities and designation of M&S proponents.

e. Responsibilities and designation of M&S application sponsors.

f. Responsibilities and designation of verification, validation, and accreditation agents.

g. VV&A Resources.

h. VV&A documentation procedures and responsibilities.

i. DoD Component VV&A focal point designation, authority, and responsibilities

2. Verification and validation (V&V) shall be:

a. Commensurate with the relative importance and stage of development of the model, simulation, or federation of models and simulations to which they are applied.

b. The responsibility of the M&S proponent.

c. Required after the effective date of this Instruction, as follows:

(1) For all major M&S developments. Major M&S include, but are not limited to, M&S whose intended application will require accreditation by DoD

or Component policy; that will be elements of a federation of models and simulations; that are intended for reuse; whose application involves safety of life; and whose development will involve the commitment of significant DoD resources.

(2) When existing models and simulations undergo major upgrade or modification.

d. Incorporated into the development and life-cycle management processes of all major M&S

e. Encouraged for all major M&S in current use in the Department of Defense.

3. V&V plans shall be developed concurrently upon initiation of development of major M&S or major upgrade of an existing M&S to include programming of V&V resources. The appropriate DoD MSEAs will be consulted during plan development if the M&S will involve representations within the MSEAs' problem domain(s). V&V plans shall be documented consistent with the minimum information in paragraphs F.4.a. and F.4.b., below.

4. V&V information shall be documented and shall, as a minimum, include:

a. For verification:

(1) Identification of the verification agent.

(2) A description of the model or simulation version or release and developing organization.

(3) Complete identification and description of the verification methodologies and activities, organizations, and individuals involved in the verification.

(4) Results of the verification effort, including any identified M&S limitations.

b. For validation:

(1) Identification of the validation agent.

(2) A description of the model or simulation version or release and developing organization.

(3) Complete identification and description of the validation methodologies and activities, organizations, and individuals involved in the validation.

(4) Results of the validation effort, including any identified M&S limitations.

5. Accreditation is the responsibility of the M&S application sponsor.

6. Accreditation results shall be documented by the application sponsor and shall include the following:

- a. Identification of the accreditation agent if different from the application sponsor.
 - b. A description of the model, simulation, or federation of models and simulations.
 - c. The intended purpose.
 - d. The assumptions; scenarios; representations of concepts, tactics, techniques, and procedures; forces, processes, and doctrine from both friendly and opposing force perspectives as used in the M&S.
 - e. Description of the accreditation methodology including V&V activities that support accreditation; data verification, validation, and certification (VV&C); and accreditation criteria.
 - f. The accreditation agent's evaluation to include capabilities and limitations as they affect the appropriateness of the model, simulation, or federation of models and simulations for the intended purposes.
 - g. The application sponsor's decision on whether or not to accredit the particular specific model, simulation, or federation of models and simulations for the intended purpose.
7. The DoD Component responsible for managing a federation of models and simulations shall have the same responsibility for federation VV&A policies, procedures, and activities as does the proponent of individual models and simulations.
8. V&V of the individual models and simulations used in a federation shall remain the responsibility of the DoD Component managing that federation element.
9. The DoD Component sponsoring an application of a federation of models and simulations shall be responsible for accreditation of the federation for the intended purpose. The application sponsor may designate other DoD Components to act as accreditation agents for the federation, with the concurrence of the designated DoD Component.
10. The accreditation of a federation of models and simulations shall include a determination as follows that:
- a. Federation elements can appropriately exchange data.
 - b. Data items being exchanged are accurate and comparable across the federation to the extent required.
 - c. Response times are commensurate across all system elements.
 - d. The degree to which the federation is complete and meets real-world behavior, appearance, performance, fidelity, and interoperability expectations are acceptable for the intended purpose.
11. V&V activities for a particular M&S application involving representations within the problem domain of an MSEA shall be coordinated with that MSEA.

12. V&V of foreign threat forces in M&S shall be formally coordinated with the appropriate threat authorities through the Defense Intelligence Agency (DIA) to ensure conformance with established intelligence positions and assessments.

13. M&S in support of DoD activities that are developed or used by non-DoD Government Organizations, contractors (including federally funded research and development centers), academic institutions, and any other non-DoD organizations shall comply with DoD VV&A policies and procedures. The DoD Component sponsoring the non-DoD M&S application is responsible for ensuring compliance with established VV&A policies and procedures.

G. INFORMATION REQUIREMENTS

The USD(A&T) may establish information reporting requirements, in accordance with DoD Directive 8910.1 (reference (g)) to assist in the management of DoD VV&A activities. When possible, existing information systems shall be used or modified rather than creating new systems.

H. EFFECTIVE DATE

This Instruction is effective immediately.

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Enclosures - 2

1. References
2. Definitions

REFERENCES, continued

- (e) DoD Directive 7045.14, "The Planning, Programming, and Budgeting System (PPBS)," May 22, 1984
- (f) Memorandum for the Chairman (MCM) 76-92, "Charter of the Joint Requirements Oversight Council"
- (g) DoD Directive 8320.1, "DoD Data Administration," September 26, 1991
- (h) DoD Directive 8000.1, "Defense Information Management (IM) Program," October 27, 1992
- (i) DoD Directive 8120.1, "Life-Cycle Management of Automated Information Systems (AISs)," January 14, 1993

- (j) DoD Directive 8910.1, "Management and Control of Information Requirements," June 11, 1993
- (k) DoD 8910.1-M, "DoD Procedures for Management of Information Requirements," November 1986, authorized by DoD Directive 8910.1, June 11, 1993
- (l) DoD STD 498, "Software Development and Documentation," December 5, 1994

DEFINITIONS

1. Accreditation. The official certification that a model, simulation, or federation of models and simulations is acceptable for use for a specific purpose.

2. Accreditation Agent. The organization designated by the application sponsor to conduct an accreditation assessment for a M&S application.

3. Accreditation Criteria. A set of standards that a particular model , simulation, or federation of models and simulations must meet to be accredited for a specific purpose.

4. Common-Use M&S. M&S applications, services, or materials provided by a DoD Component to two or more DoD Components.

5. Cooperative Development. A project in which two or more DoD Components share in domain research, technical studies, or technology development that may result in dissimilar M&S applications.

6. Data Certification. The determination that data have been verified and validated.

7. Data Validation. The documented assessment of data by subject area experts and its comparison to known values.

8. Data Verification. Data verification is the use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling.

9. DoD Component Verification, Validation, Accreditation (VV&A) Focal Point. An organization, designated by each DoD Component, as its authoritative, single point of contact for information and data on, as a minimum, that DoD Component's VV&A policies and procedures, V&V results, and accreditation documentation. The DoD Component VV&A focal point shall be the designated point of contact to work with the DoD VV&A focal point on VV&A issues. (See definition 15., below,)

10. DoD Issuance. DoD Directives, Instructions, Publications, and their Changes. (See definition 20., below.)

11. DoD Modeling and Simulation (M&S) Executive Agent (MSEA). A DoD Component to whom the USD(A&T) has assigned responsibility and delegated authority for coordinating the development and maintenance of a specific area of general or common-use M&S application, including relevant standards and data bases, used by or common to many models and simulations

12. DoD Modeling and Simulation (M&S) Resource Repository (MSRR). A. A geographically distributed and networked series of automated information systems that contain unclassified, classified, or both classified and unclassified data and information on M&S that is accessible by DoD-authorized users. B. A single DoD node, source or site that contains M&S data and/or information that may or may not be part of the DoD MSRR network.

13. DoD Publications. DoD issuances that implement or supplement DoD Directives and Instructions by providing uniform procedures for management or operational systems and disseminating administrative information. DoD Publications include: Catalogs, Directories, Guides, Handbooks, Indexes, Inventories, Lists, Manuals, Modules, Pamphlets, Plans, Regulations, and Standards that implement or supplement DoD Directives or Instructions.

14. DoD VV&A Focal Point. A DoD organization designated as the authoritative, single point of contact for DoD and non-DoD activities on the data and information on DoD VV&A policies, procedures and practices, V&V results, and accreditation documentation.

15. Executive Council for Modeling and Simulation (EXCIMS). An organization established by the USD(A&T) and responsible for providing advice and assistance on DoD M&S issues. Membership is determined by the USD(A&T) and is at the Senior Executive Service, flag, and general officer level.

16. Federation Element. Term applied to an individual model or simulation that is part of a federation of models and simulations. Federation elements may be distributed.

17. Federation of Models and Simulations. A system of interacting models and/or simulations, with supporting infrastructure, based on a common understanding of the objects portrayed in the system. (See definition 17., above.)

18. General-use M&S Applications. Specific representations of the physical environment or environmental effects used by, or common to, many models and simulations; e.g., terrain, atmospheric, or hydrographic effects.

19. Implementation. The publication by the DoD Components of directives, instructions, regulations, and related documents that define responsibilities and authorities and establish the internal management processes necessary to carry out the policies required by a DoD issuance.

20. Joint M&S. Abstract representations of joint and Service forces, capabilities, equipment, materiel, and services used in the joint environment by two, or more, Military Services.

21. Joint Training. Military training based on joint doctrine to prepare joint forces or joint staffs to respond to operational requirements deemed necessary by the CINCs to execute their assigned missions.

22. Major Modeling and Simulation (M&S). M&S which include, but are not limited to, M&S: whose intended application will require accreditation by DoD or Component policy; that will be elements of a federation of models and simulations; that are intended for reuse; whose application involves safety of life; and, whose development will involve the commitment of significant DoD resources.

23. Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

24. Modeling and Simulation. The development and use of live, virtual, and constructive models including simulators, stimulators, emulators, and prototypes to investigate, understand, or provide experiential stimulus to either (1) conceptual systems that do not exist or (2) real life systems which cannot accept experimentation or observation because of resource, range, security, or safety limitations. This investigation and understanding in a synthetic environment will support decisions in the domains of research, development, and acquisition and analysis, or transfer necessary experiential effects in the education, training, and military operations domain.

25. Modeling and Simulation (M&S) Application. A specific, individual project session that requires or uses an M&S to achieve its purpose.

26. Modeling and Simulation (M&S) Application Sponsor. The organization that utilizes the results or products from a specific application of a model or simulation.

27. Modeling and Simulation (M&S) Developer. The organization responsible for managing or overseeing M&S developed by a DoD Component, contractor, or Federally Funded Research and Development Center.

28. Modeling and Simulation (M&S) Proponent. The agency or organization that has primary responsibility for M&S in its area of interest.

29. Modeling and Simulation (M&S) Interoperability. The ability of a model or simulation to provide services to, and accept services from, other models and simulations, and to use the services so exchanged to enable these M&S to operate effectively together.

30. DoD Modeling and Simulation (M&S) Investment Plan. A DoD plan, published under the authority of the USD(A&T) and with the coordination of the DoD Components, that establishes short-term (present to 6 years) and long-term (beyond 6 years) programs and funding for joint and common use M&S to achieve the specified goals and objectives outlined in the DoD M&S Master Plan.

31. DoD Modeling and Simulation (M&S) Master Plan. A DoD plan, published under the authority of the USD(A&T) and with the coordination of the DoD Components, that establishes short-term (present to 6 years) and long-term (beyond 6 years) DoD goals and objectives for the application of M&S for joint and common use within the Department of Defense. It shall also include an assessment of current M&S capabilities, a status report on M&S efforts under development, and a road map that delineates the management, investment, and technical strategies required to achieve DoD M&S objectives.

32. Simulation. A method for implementing a model over time. Also, a technique for testing, analysis, or training in which real-world systems are used, or where real-world and conceptual systems are reproduced by a model.

33. Supplementation. The publication by the DoD Components of directives, instructions, regulations, and related documents that add to, restrict, or otherwise modify the policies and procedures of DoD issuances.

34. Validation. The process of determining the degree to which a model is an accurate representation of the real-world from the perspective of the intended uses of the model.

35. Validation Agent. The organization designated by the M&S sponsor to perform validation of a model, simulation, or federation of models and/or simulations.

36. Verification. The process of determining that a model implementation accurately represents the developer's conceptual description and specifications.

37. Verification Agent. The organization designated by the M&S sponsor to perform verification of a model, simulation, or federation of models and/or simulations.